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(12) **United States Patent**
Kimura

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(45) **Date of Patent: Feb. 11, 2014**

(54) **CONNECTOR**

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(73) Assignee: **Japan Aviation Electronics Industry, Limited**, Tokyo (JP)

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**
H01R 13/62 (2006.01)

(52) **U.S. Cl.**
USPC **439/326**

(58) **Field of Classification Search**
USPC 439/326
See application file for complete search history.

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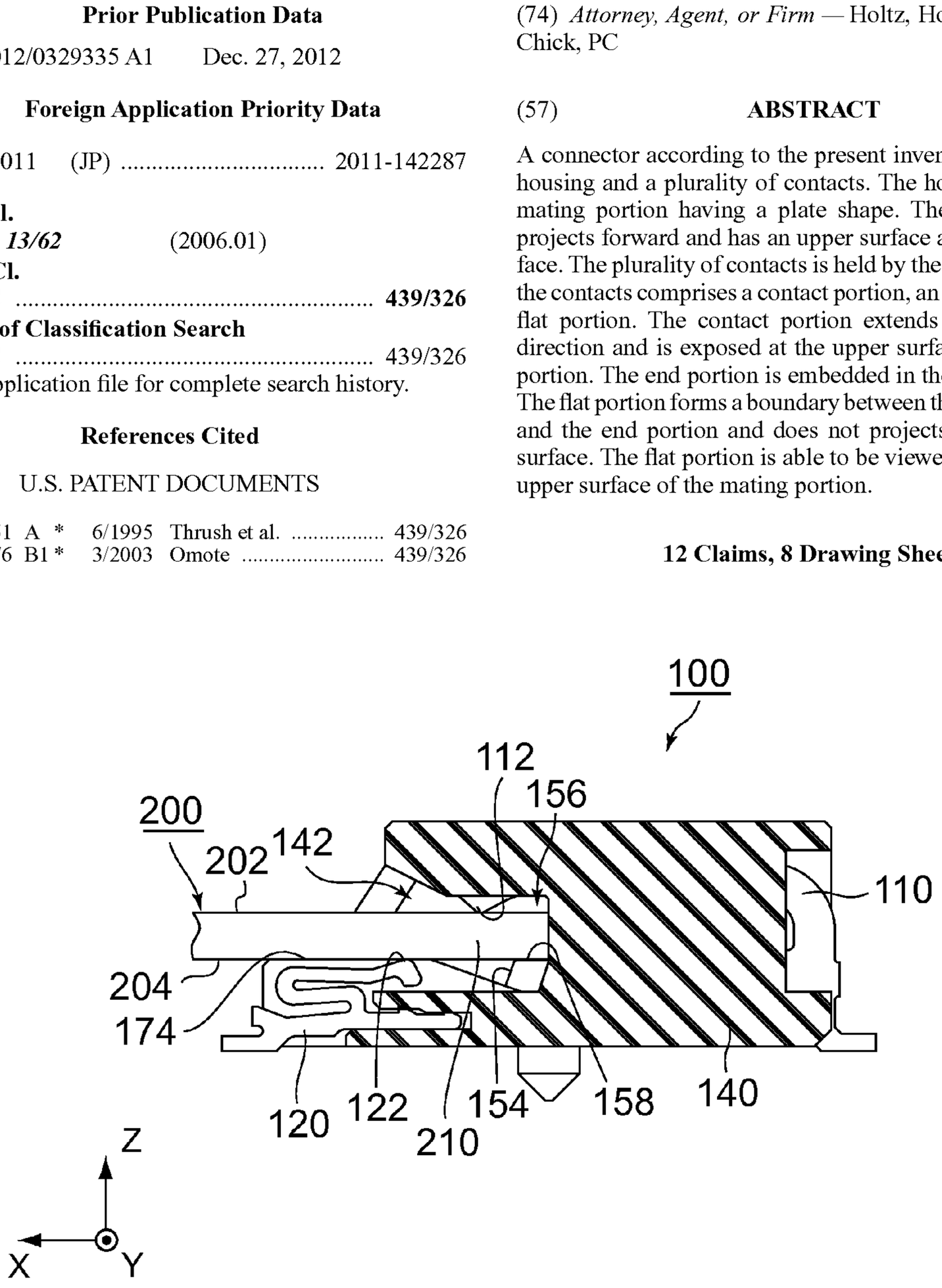
(57) **ABSTRACT**

A connector according to the present invention comprises a housing and a plurality of contacts. The housing includes a mating portion having a plate shape. The mating portion projects forward and has an upper surface and a bottom surface. The plurality of contacts is held by the housing. Each of the contacts comprises a contact portion, an end portion and a flat portion. The contact portion extends in a connection direction and is exposed at the upper surface of the mating portion. The end portion is embedded in the mating portion. The flat portion forms a boundary between the contact portion and the end portion and does not projects from the upper surface. The flat portion is able to be viewed from above the upper surface of the mating portion.

12 Claims, 8 Drawing Sheets



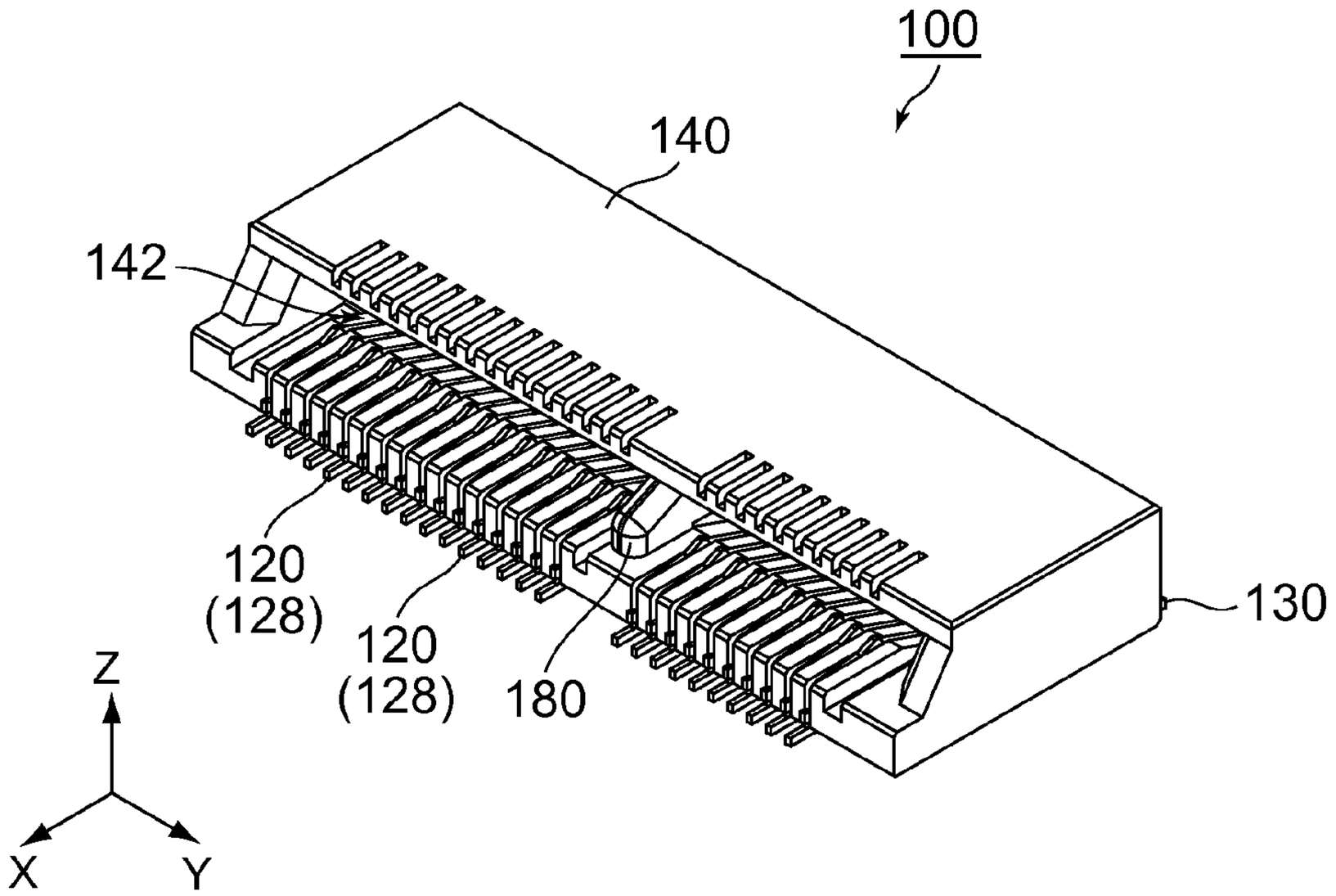

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Fig. 1

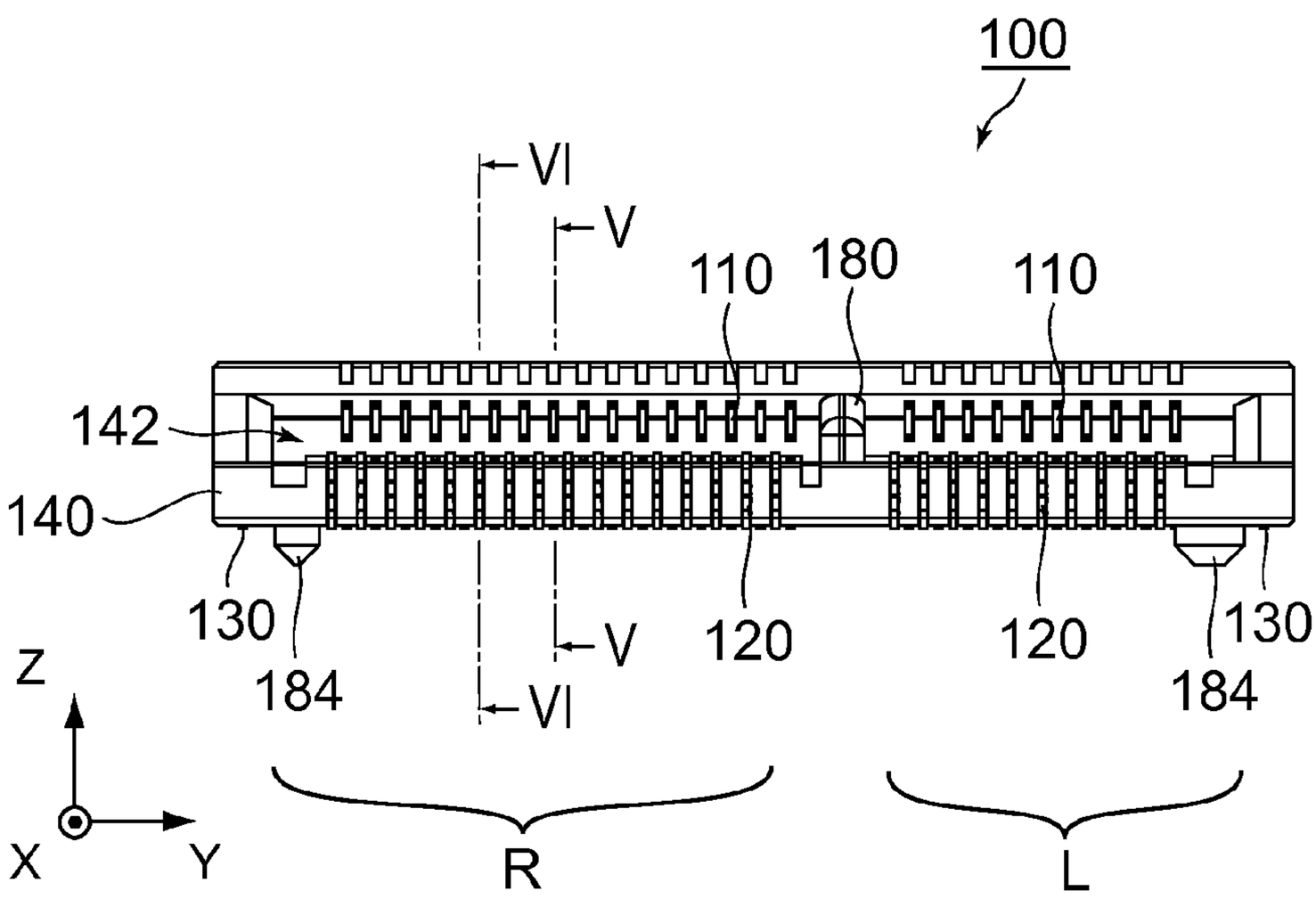
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Fig. 2

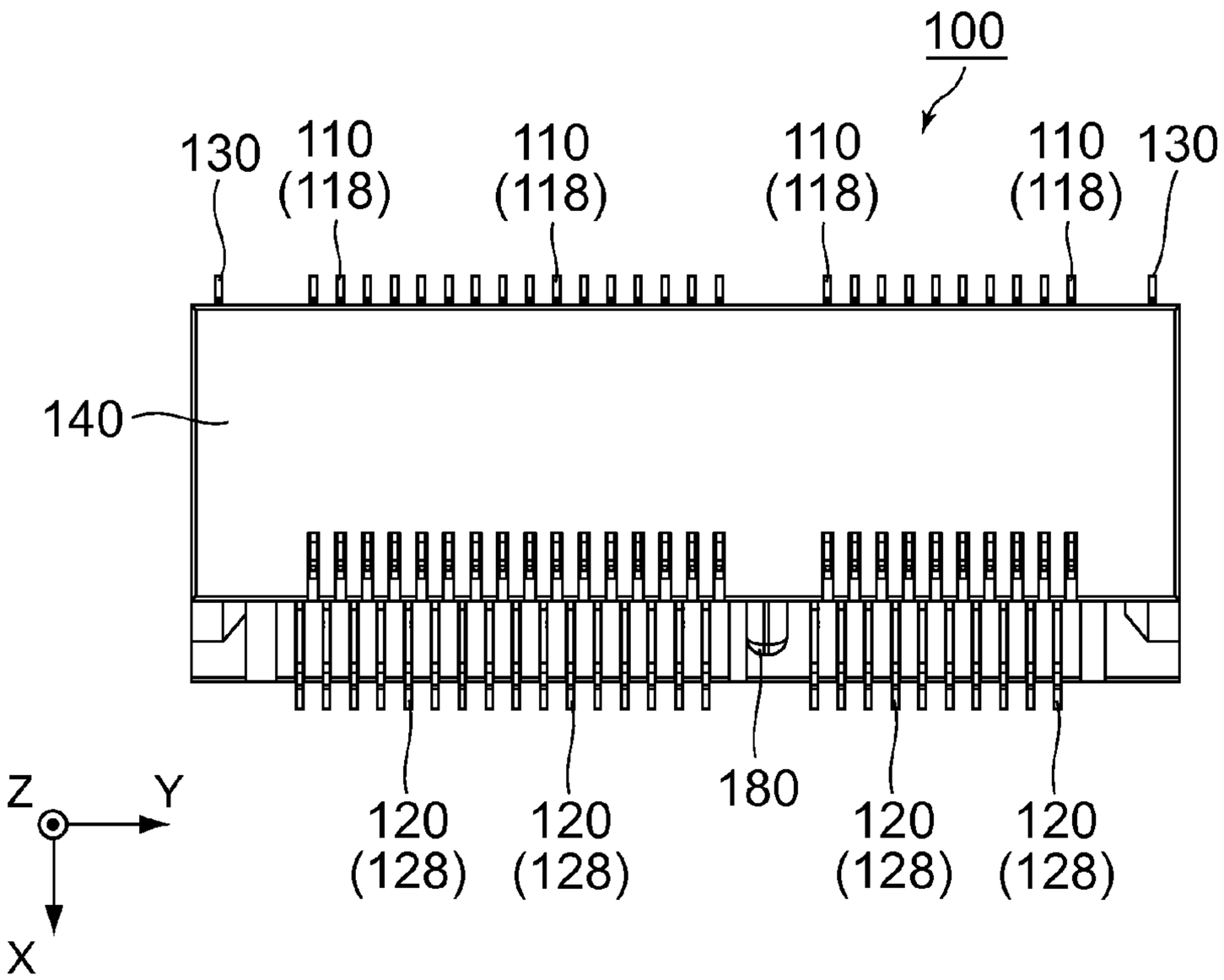
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Fig. 3

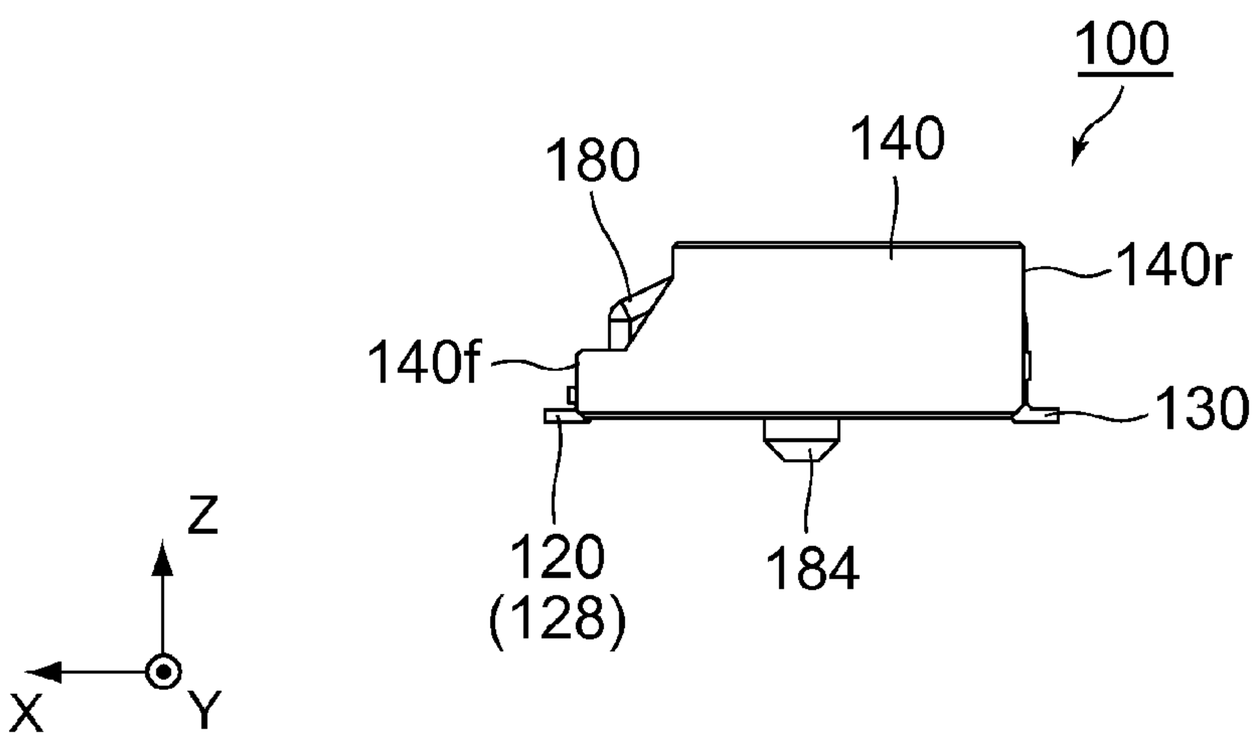
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Fig. 4

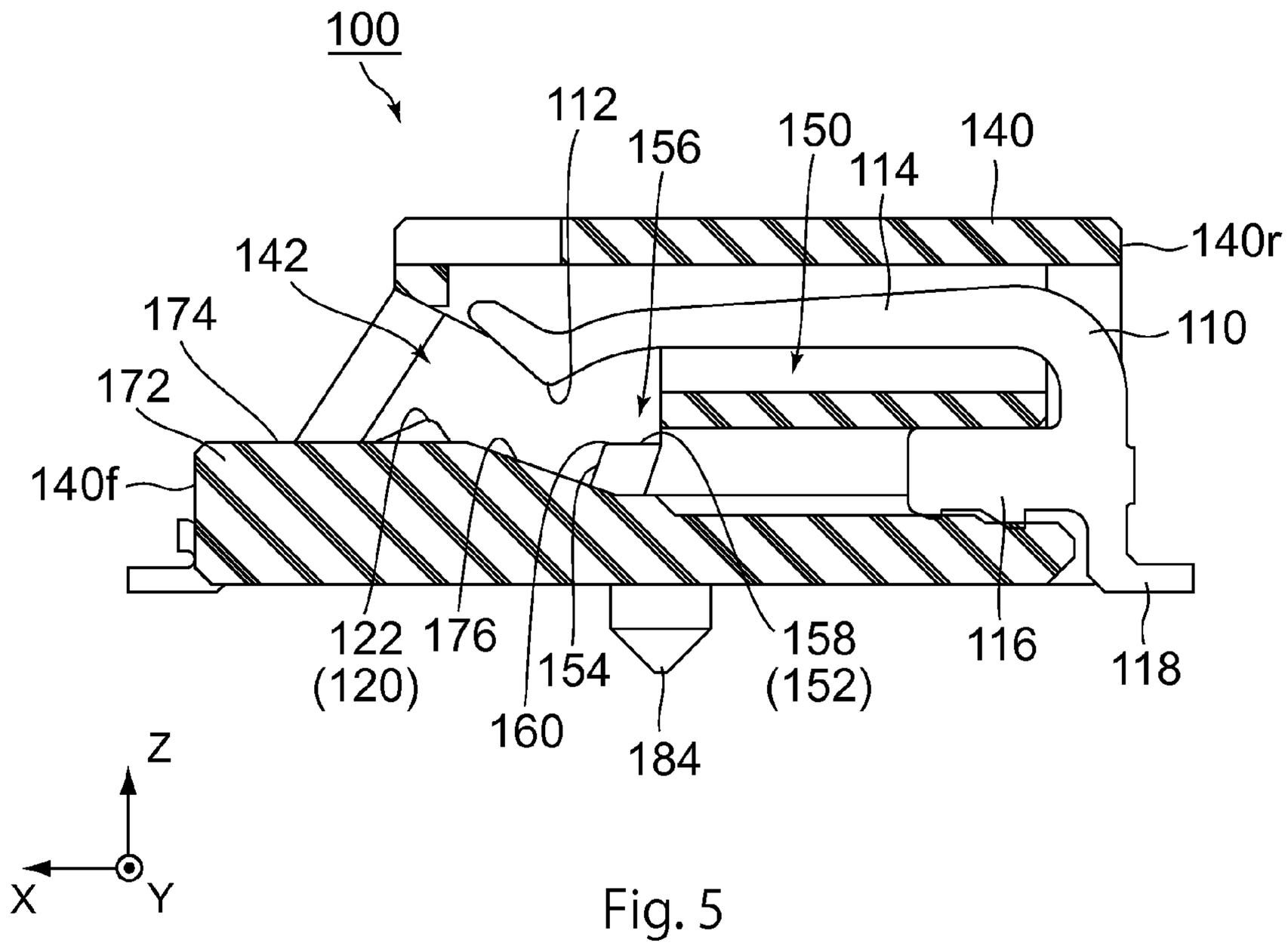
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Fig. 5

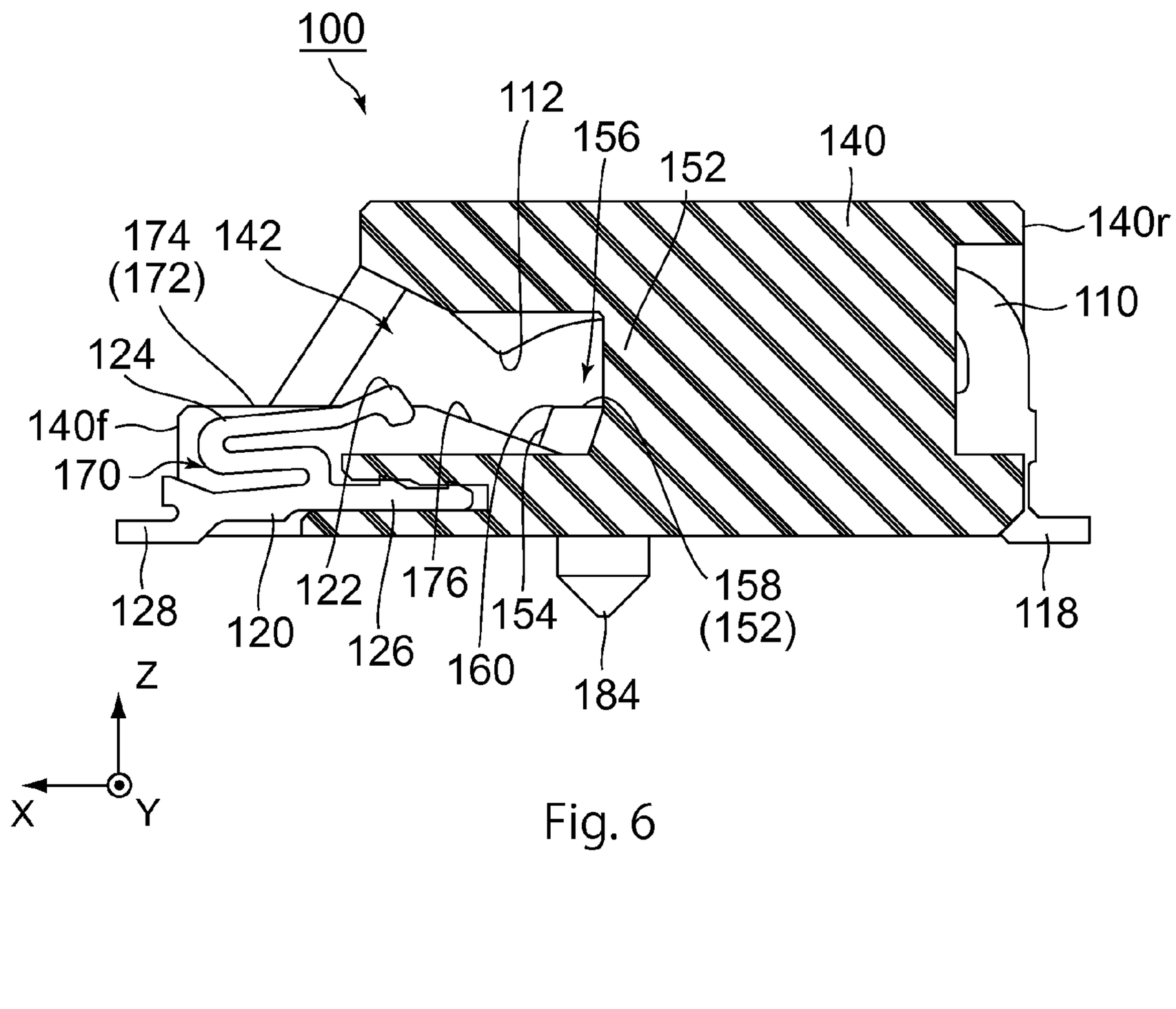
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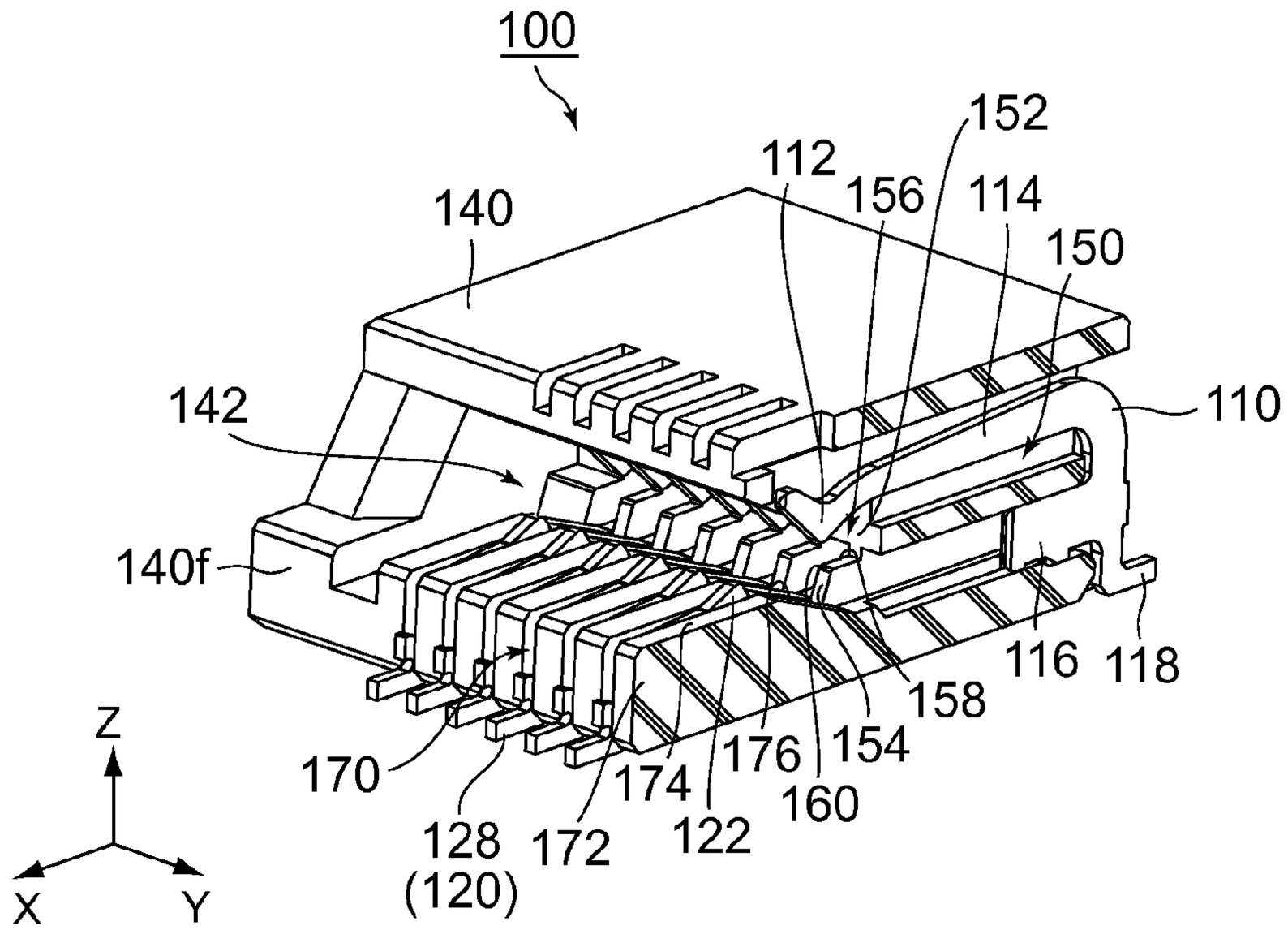
Fig. 6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172
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Fig. 7

100
200
210
202
142
112
156
212
A
D
110
204
174
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122
154
158
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Z
X
Y

Fig. 8

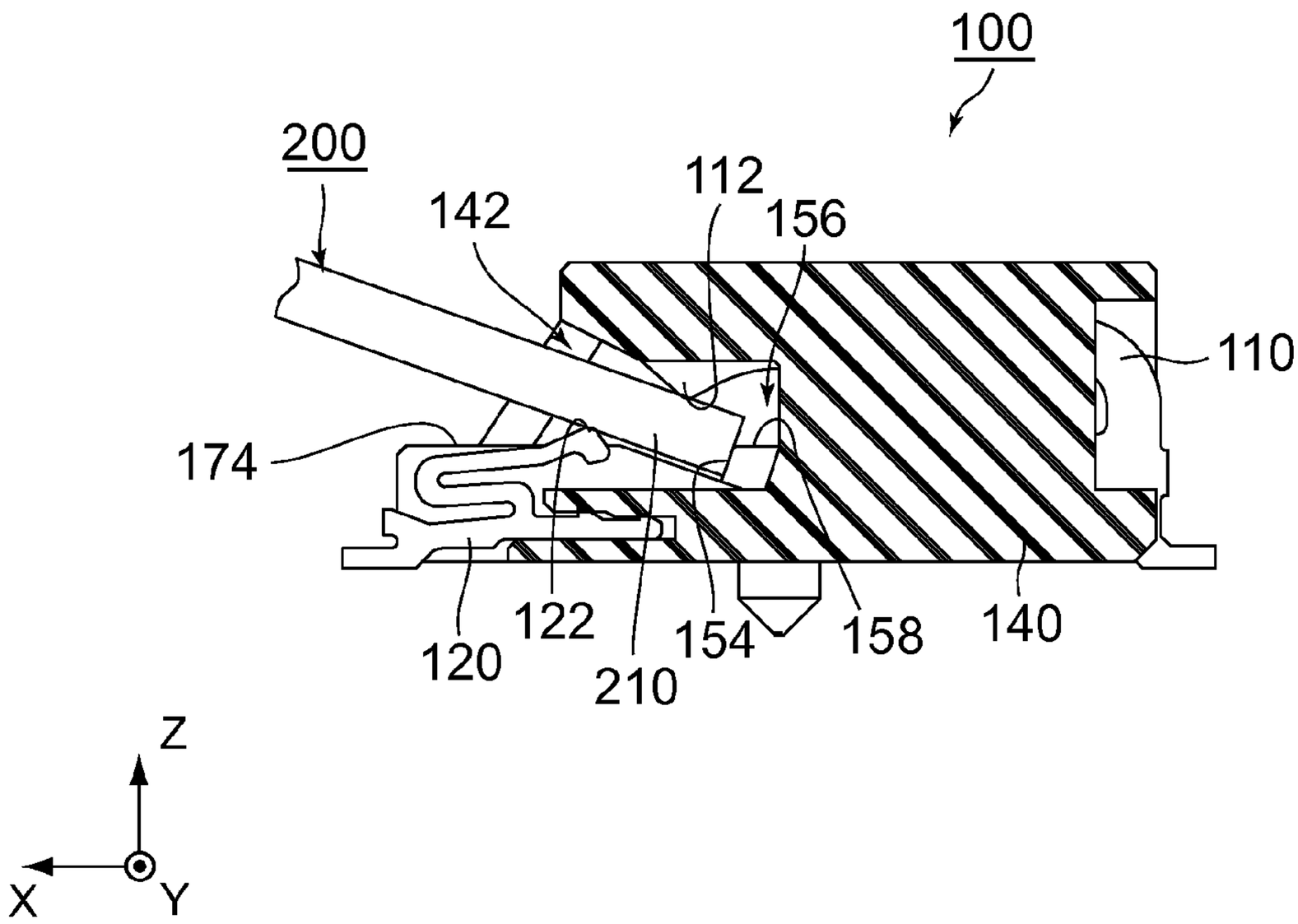
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Fig. 9

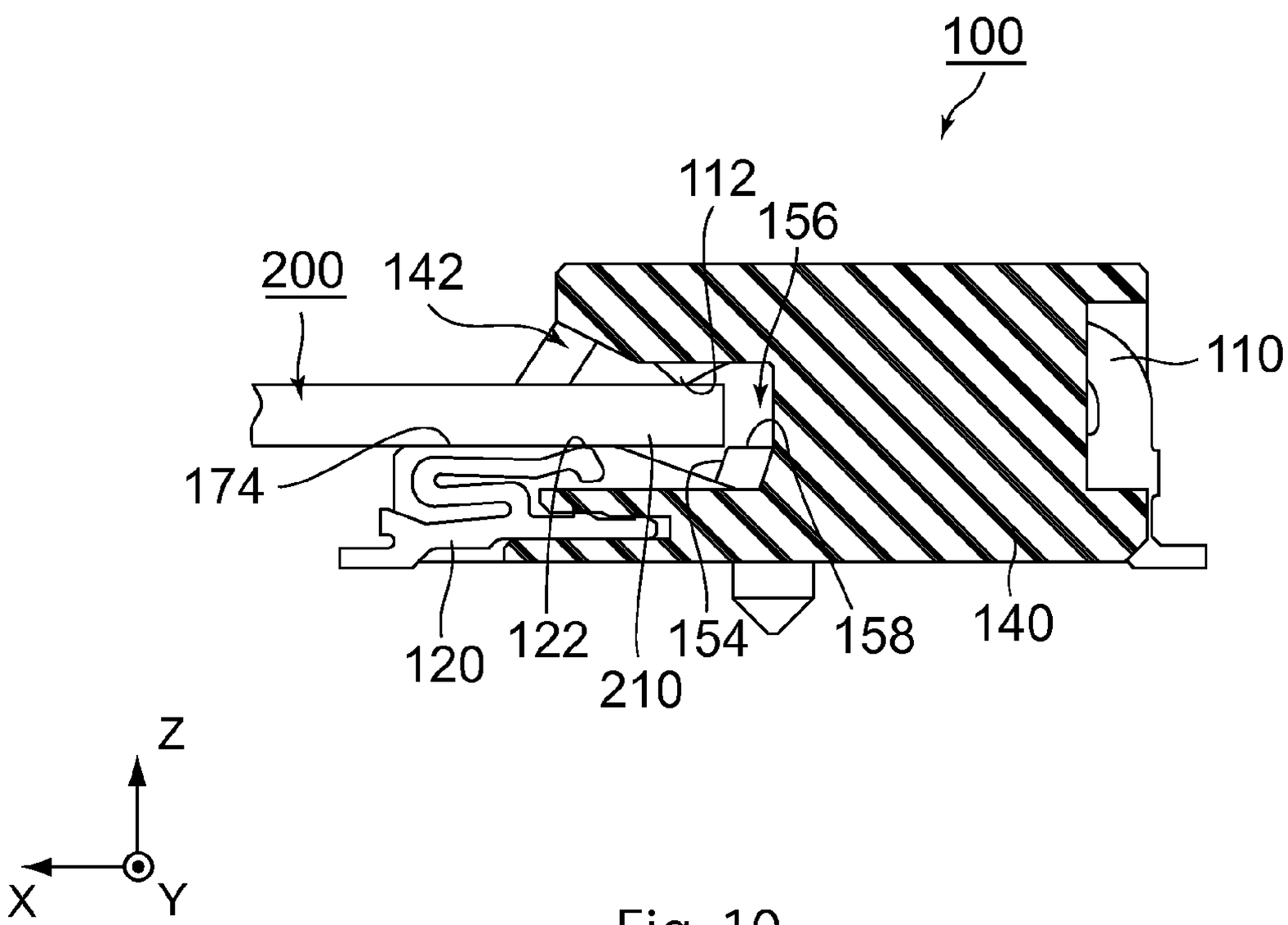
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Fig. 10

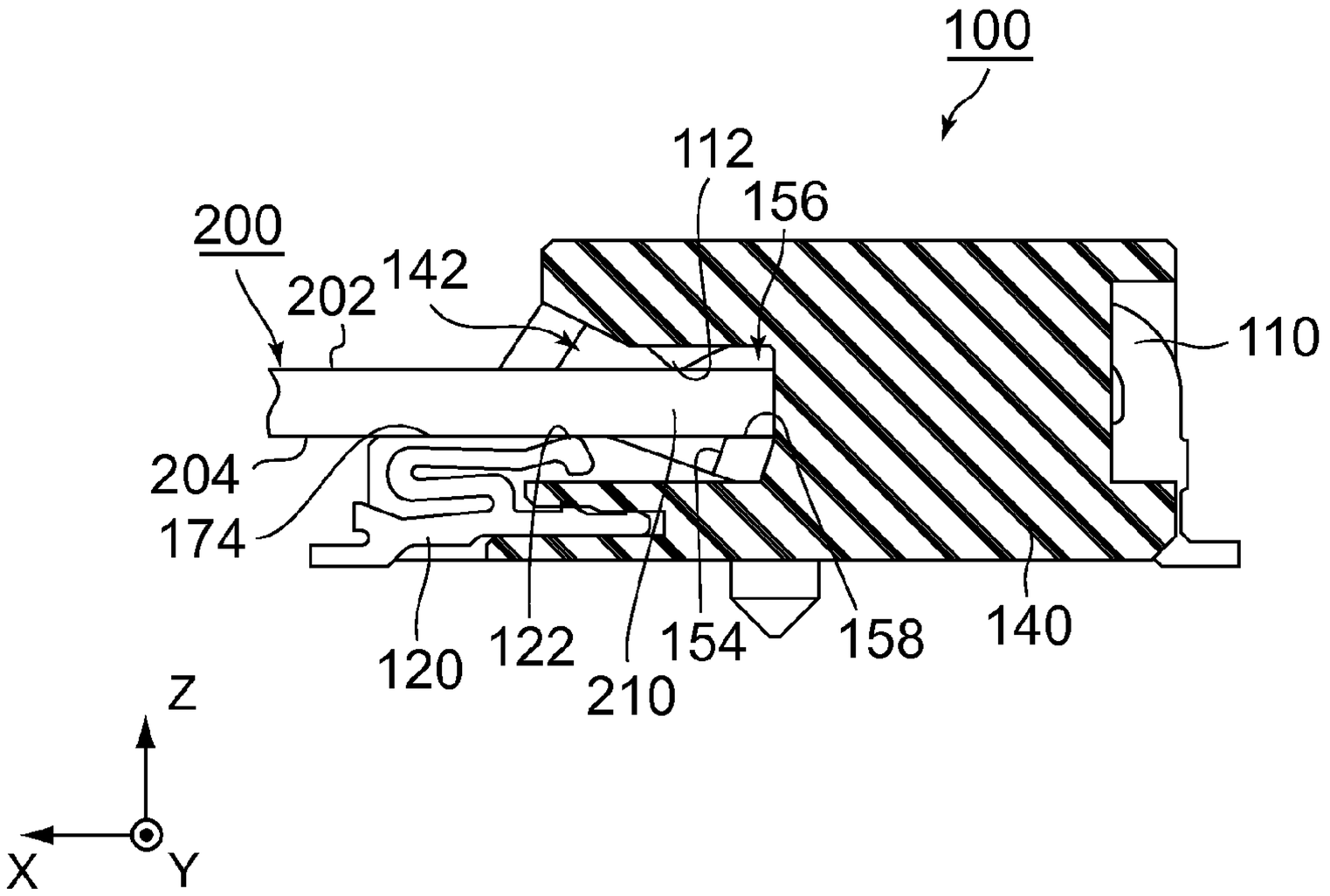
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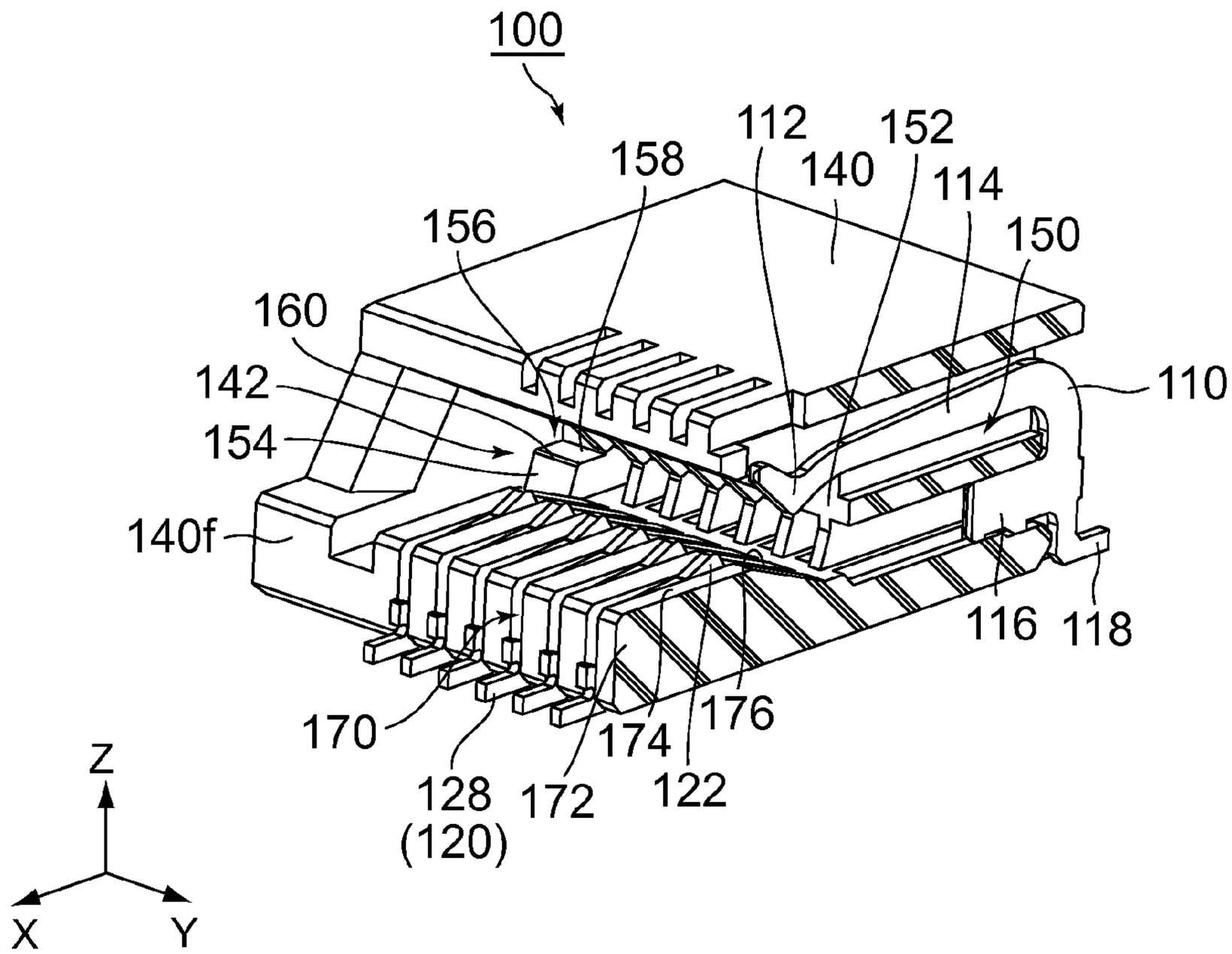
Fig. 11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(120)
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Fig. 12

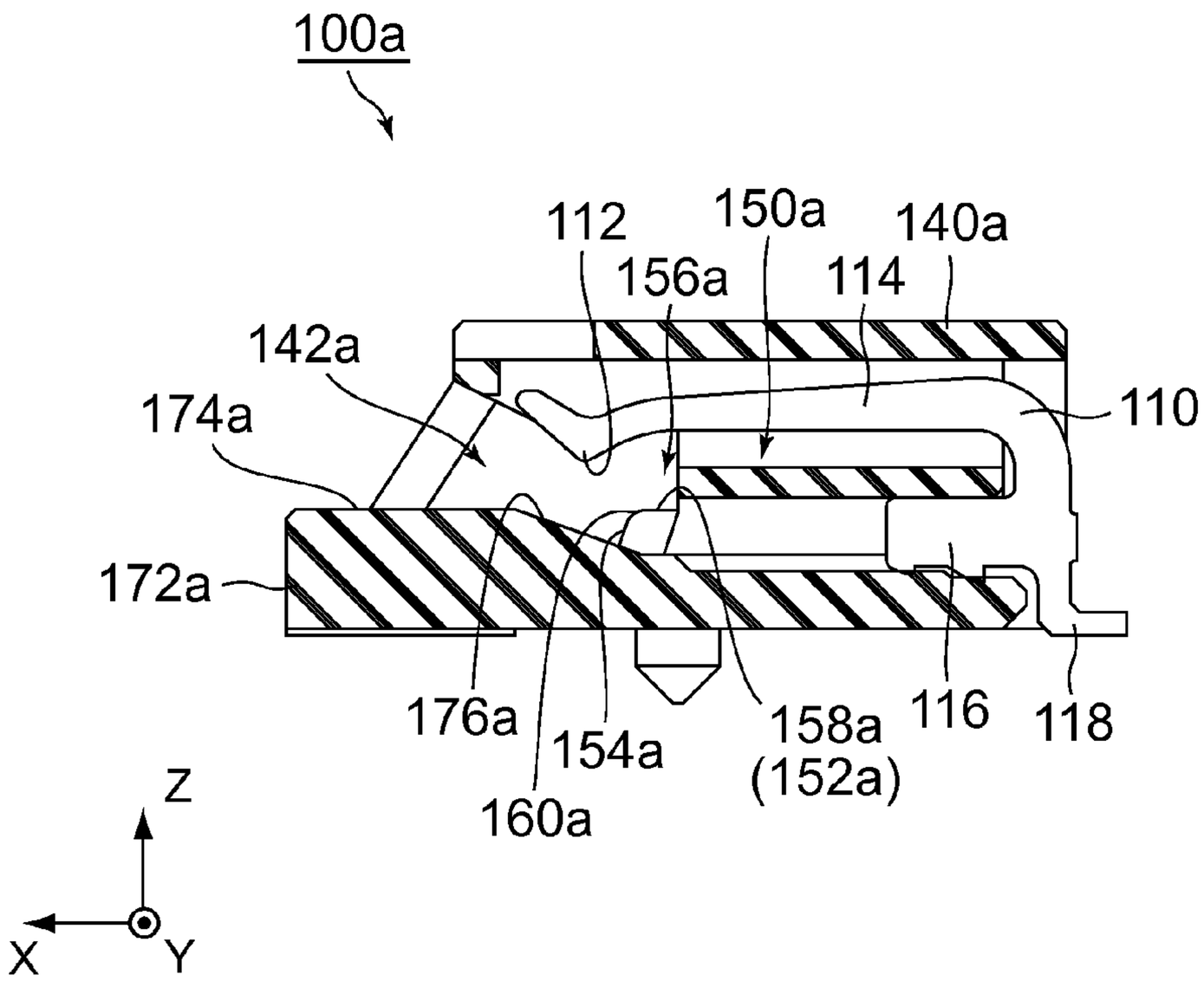
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Fig. 13

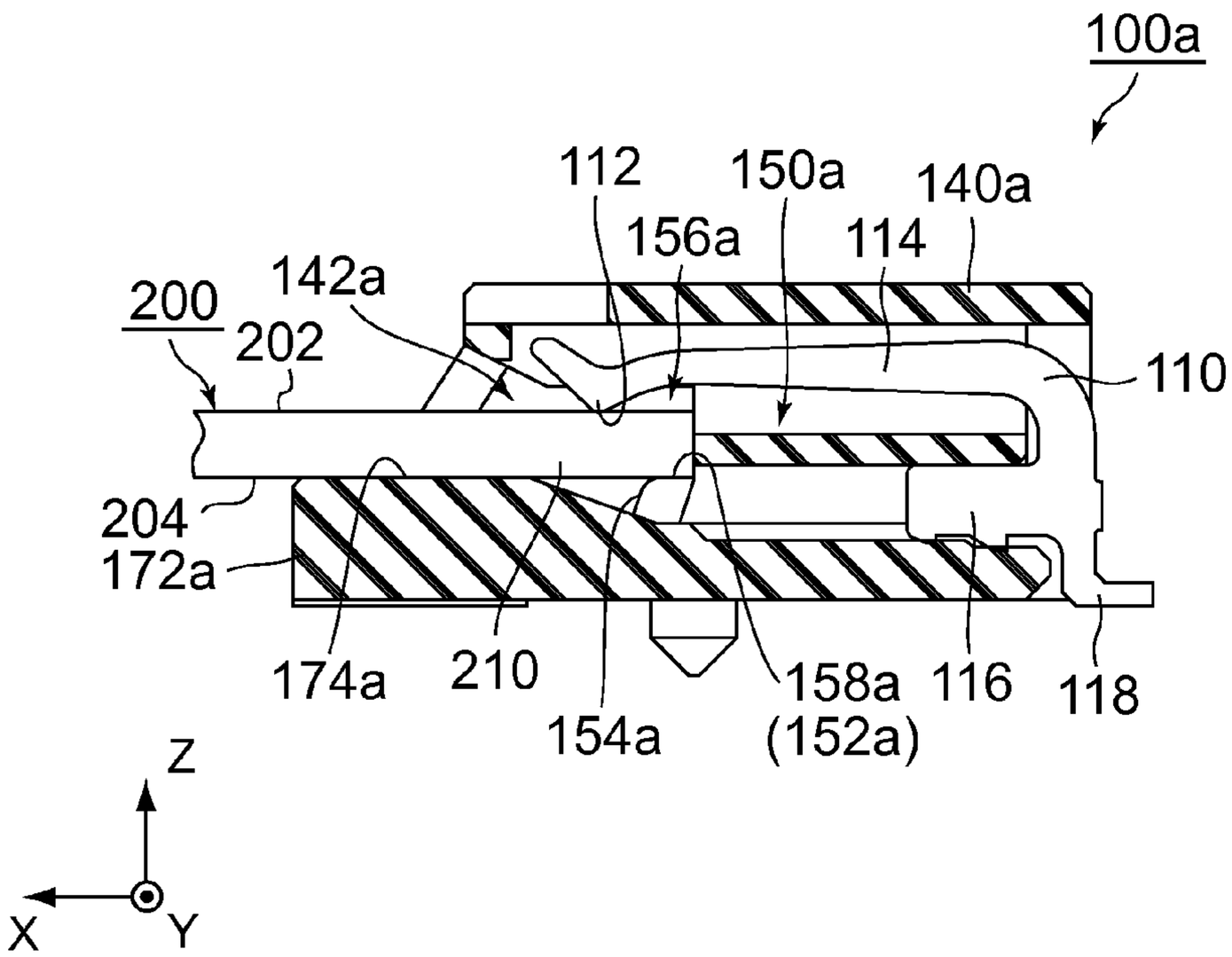
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Fig. 14

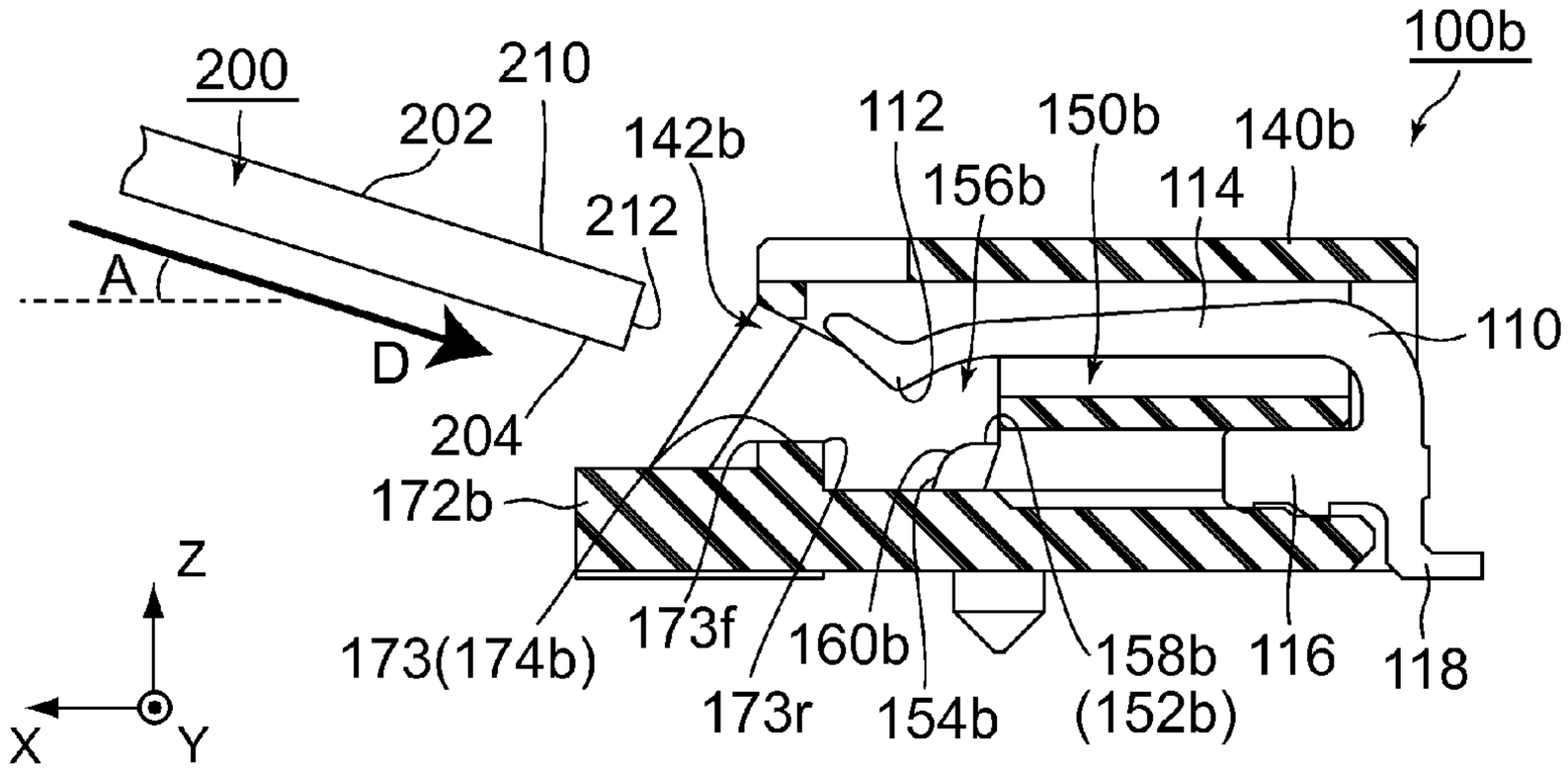

Fig. 15

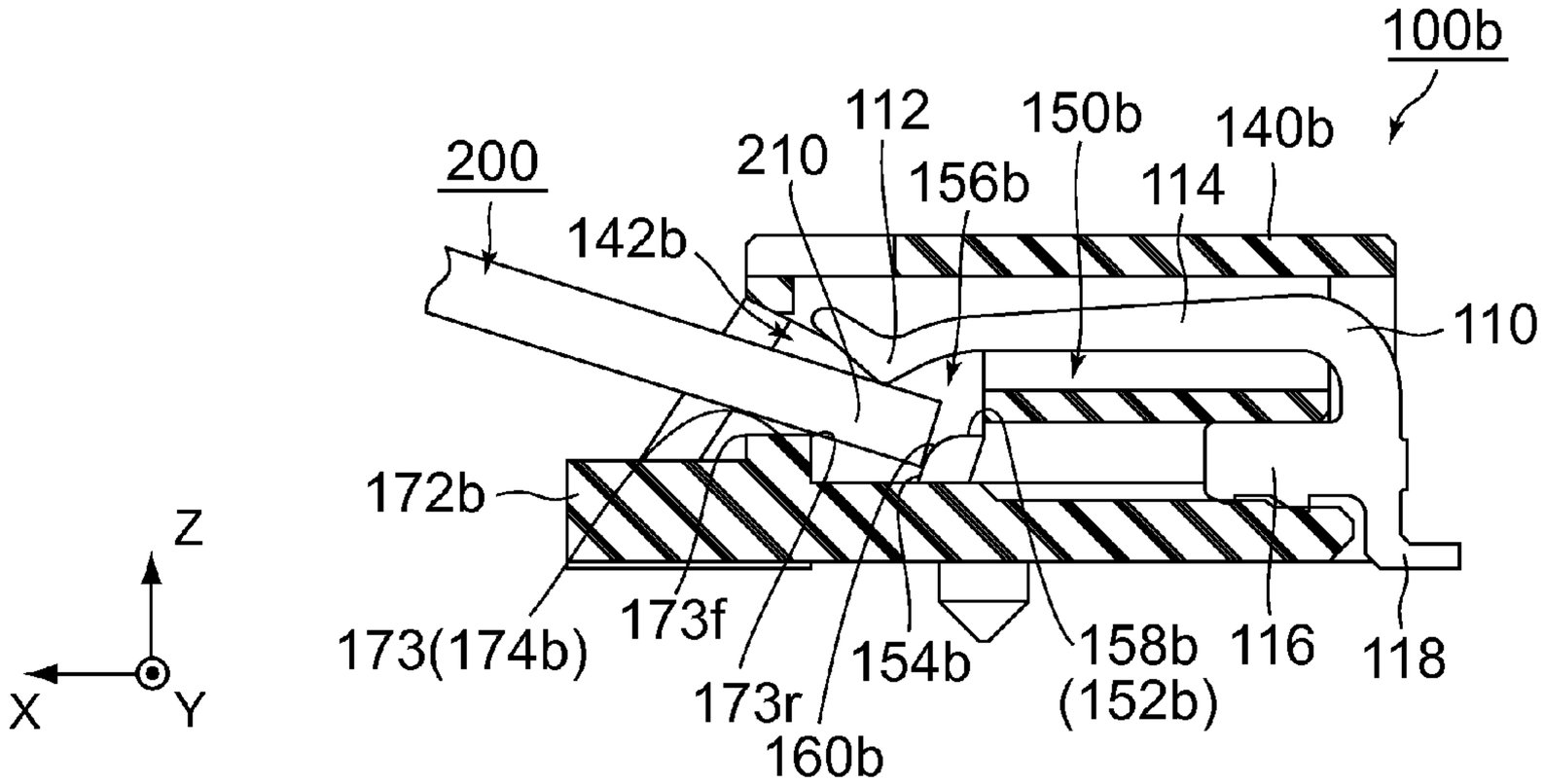

Fig. 16

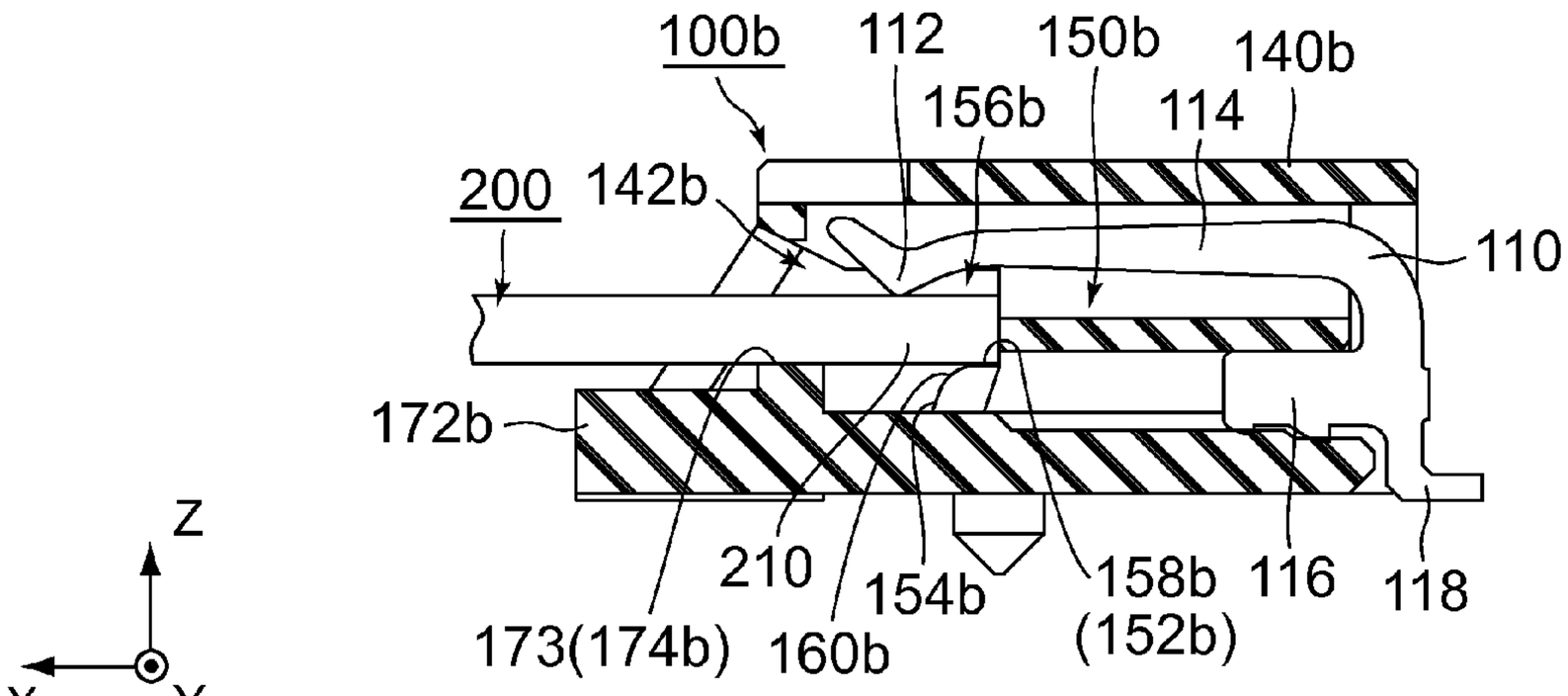

Fig. 17

CONNECTOR

CROSS REFERENCE TO RELATED APPLICATIONS

Applicant claims priority under 35 U.S.C. §119 of Japanese Patent Application No. JP 2011-142287 filed Jun. 27, 2011.

BACKGROUND OF THE INVENTION

The present invention relates to an electrical connector such as a card-edge connector. The electrical connector is connected with a connection object which has mating portion having a plate-like shape. The connection object is, for example, a semiconductor module such as a memory module.

Electrical connectors of the above-mentioned type are disclosed in JP-A H9-139261 and JP-A H9-45437, each of which is incorporated herein by reference in their entirety. The electrical connector disclosed in JP-A H9-139261 is a card-edge connector connected with a card. The card is inserted to the card-edge connector in an obliquely direction and is brought down till the card is in parallel with a horizontal direction so that the card-edge connector is connected with the card. The card is engaged with an engaged portion (a latch portion) of the card-edge connector so that a connection between the card-edge connector and the card is maintained. The electrical connector disclosed in JP-A H9-45437 is connected with a cable connector. The cable connector is inserted to the electrical connector in an oblique direction and is brought down till the cable connector is in parallel with the horizontal direction so that the electrical connector is connected with the cable connector. An engage portion of the cable connector is engaged with an engaged portion (recessed portion) of the electrical connector so that connection between the electrical connector and the cable connector is maintained.

Connection objects (the card and the cable connector) mentioned above can be inserted to the electrical connectors with low insertion force even when the electrical connectors have a plurality of contacts.

However, the connection object receives restoring force by the contacts of the electrical connector when the connection object is connected with the electrical connector. Because of the restoring force by the contacts, the connection object may be bent and deformed. Therefore, the connection objects connected with the above electrical connectors are required to be strong. In other words, a thin connection objects can not be used for the above electrical connectors.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide an electrical connector which does not apply excessive force to a connection object while the electrical connector and a connection object are connected with each other.

One aspect of the present invention provides an electrical connector configured to be connected with a connection object which has a mating portion having a plate shape. The electrical connector comprises: an insertion opening into which the connection object is inserted in an oblique direction; a contacted portion with which the mating portion inserted through the insertion opening is brought into contact; a receiving portion receiving the mating portion and having a first support portion, the receiving portion being positioned at a back of the contacted portion; a contact portion positioned forward and upward of the first support portion and being displaceable in an up-down direction; and a second support portion positioned forward and downward of the contact portion. The mating portion is inserted through the insertion opening so as to be positioned at a first position where the mating portion is in contact with the contacted portion, the mating portion being brought down so as to be positioned at a second position where the mating portion is in parallel with a front-back direction perpendicular to the up-down direction, the mating portion being moved backward so as to be positioned at a third position where the mating portion is received by the receiving portion and supported by the first support portion, the second support portion, and the contact portion.

An appreciation of the objectives of the present invention and a more complete understanding of its structure may be had by studying the following description of the preferred embodiment and by referring to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an oblique view showing an electrical connector according to an embodiment of the present invention.

FIG. **2** is a front view showing the electrical connector of FIG. **1**.

FIG. **3** is a top view showing the electrical connector of FIG. **1**.

FIG. **4** is a side view showing the electrical connector of FIG. **1**.

FIG. **5** is a cross-sectional view showing the electrical connector of FIG. **2**, taken along lines V-V.

FIG. **6** is a cross-sectional view showing the electrical connector of FIG. **2**, taken along lines VI-VI.

FIG. **7** is an oblique view showing a cross section of the electrical connector of FIG. **5**.

FIG. **8** is a cross-sectional view showing the electrical connector and the connection object. The connection object is not inserted into the insertion opening.

FIG. **9** is a cross-sectional view showing a first step of a connection process. The connection object is positioned at a first position.

FIG. **10** is a cross-sectional view showing a second step of the connection process. The connection object is positioned at a second position.

FIG. **11** is a cross-sectional view showing a third step of the connection process. The connection object is positioned at a third position.

FIG. **12** is an oblique view showing a cross section of a first variation example of the electrical connector of FIG. **7**.

FIG. **13** is a cross-sectional view showing a cross section of a second variation example of the electrical connector of FIG. **5**.

FIG. **14** is a cross-sectional view showing the electrical connector and a connection object of FIG. **13**. The connection object is positioned at the third position.

FIG. **15** is a cross-sectional view showing a third variation example of the electrical connector of FIG. **5**. The connection object is not inserted into the insertion opening.

FIG. **16** is a cross-sectional view showing the electrical connector of FIG. **15**. The connection object is positioned at the first position.

FIG. **17** is a cross-sectional view showing the electrical connector of FIG. **15**. The connection object is positioned at the third position.

While the invention is susceptible to various alternative embodiments and alternative forms, specific embodiments thereof are shown by way of example in the drawings and will herein be described in detail. It should be understood, how-

ever, that the drawings and detailed description thereto are not intended to limit the invention to the particular form disclosed, but on the contrary, the intention is to cover all alternative embodiments, equivalents and alternatives falling within the spirit and scope of the present invention as defined by the appended claims.

DESCRIPTION OF PREFERRED EMBODIMENTS

With reference to FIG. **1** to FIG. **7**, an electrical connector **100** of the embodiment according to the present invention comprises a plurality of upper contacts **110**, a plurality of lower contacts **120**, two hold downs **130** and a holding member **140**. The upper contacts **110** and the lower contacts **120** are made of a conductive material. The holding member **140** is made of an insulative material. As shown in FIG. **8** to FIG. **11**, the electrical connector **100** is a card-edge connector connected with a connection object **200**. The connection object **200** of the embodiment is a module which has a substrate provided with a circuit and a semiconductor package. The module is for example a memory module. The connection object **200** of the embodiment has a mating portion **210** having a plate-like shape. The mating portion **210** is inserted into the electrical connector **100**. The mating portion **210** has a plurality of upper contacts (not shown) formed on an upper surface **202** and a plurality of lower contacts (not shown) formed on a lower surface **204**. The upper contacts and the lower contacts of the mating portion **210** are arranged near a front end portion **212** of the mating portion **210**.

With reference to FIG. **5**, the upper contact **110** has an upper contact portion (contact portion) **112**, an upper spring portion **114**, an upper held portion **116** and an upper fixed portion **118**. The upper spring portion **114** extends forward (in a +X direction) and elastically supports the upper contact portion **112**. The upper held portion **116** is press-fitted into the holding member **140** so that the upper contact **110** is held by the holding member **140**. The upper fixed portion **118** is soldered to a substrate (not shown) on which the electrical connector **100** is installed. The upper contact portion **112** is positioned near a free end of the upper spring portion **114**. The upper contact portion **112** is displaceable along an up-down direction (a Z direction) in a surface (in an XZ surface) defined by the up-down direction (a Z direction) and a front-back direction (an X direction). The upper contact portion **112** is brought into contact with a corresponding upper contact (not shown) of the mating portion **210**. In this embodiment, the hold down **130** has only the upper held portion **116** and the upper fixed portion **118**. The hold down **130** is soldered to the substrate so that the electrical connector **100** is fixed on the substrate.

With reference to FIG. **6**, the lower contact **120** has a lower contact portion **122**, a lower spring portion **124**, a lower held portion **126** and a lower fixed portion **128**. The lower spring portion **124** has J-like shape and elastically supports the lower contact portion **122**. The lower held portion **126** is press-fitted into the holding member **140** so that the lower contact **120** is held by the holding member **140**. The lower fixed portion **128** is soldered to the substrate. The lower contact portion **122** is positioned near a free end of the lower spring portion **124**. The lower contact portion **122** is displaceable along the up-down direction in the XZ surface and connected with the lower contact (not shown) of the mating portion **210**. The lower contact portion **122** is brought into contact with a corresponding lower contact (not shown) of the mating portion **210**.

With reference to FIG. **1** to FIG. **7**, the holding member **140** has an insertion opening **142** into which the mating portion **210** is inserted. As shown in FIG. **8**, the mating portion **210** is inserted along an oblique direction indicated with "D" in FIG. **8**. The oblique direction of the embodiment is in a −X direction and a −Z direction). In other words, the mating portion **210** is inserted into the insertion opening **142** at a predetermined angle indicated with "A" in FIG. **8** with respect to the front-back direction.

As best shown in FIG. **5** and FIG. **7**, the holding member **140** has a plurality of first accommodation portions (accommodation portions) **150** formed at a back of the insertion opening **142**. The first accommodation portion **150** communicates with the insertion opening **142** and opens backward of the holding portion **140**. As shown in FIG. **7**, the holding member **140** has a plurality of partition walls **152**. The partition walls **152** are arranged along a pitch direction (a Y direction) perpendicular to the front-end direction and the up-down direction and are in parallel with the XZ surface. The first accommodation portion **150** is positioned between neighboring partition walls **152** in the pitch direction.

With reference to FIG. **5**, the upper contact **110** is inserted into the holding member **140** so that the upper spring portion **114** is partially positioned in the first accommodation portion **150**. As shown in FIG. **1** to FIG. **3**, the holding member **140** holds the upper contacts **110** so that the upper contact portions **112** are arranged in a line in the pitch direction. The upper contact portions **112** are positioned in the insertion opening **142** when seen along the front-back direction. As understood from FIG. **3**, the hold downs **130** are attached to opposite ends of the holding member **140** in the pitch direction. Similarly to the upper contacts **110**, each of the hold downs **130** are press-fitted into and held by the holding member **140**.

As shown in FIG. **5** to FIG. **7**, each of the partition walls **152** has a projection portion and a recessed portion. The projection portion is formed at a lower part of the partition wall **152** and projecting forward. The recessed portion is formed upward and backward of the projection portion and recessed backward. As shown in FIG. **7**, each of front surfaces of the projection portions serves as a contacted portion **154**, and each of the recessed portions serves as a receiving portion **156**. When the mating portion **210** is inserted through the insertion opening **142**, the front end portion **212** of the mating portion **210** is brought into contact with the contacted portions **154** as described in detail afterwards.

With reference to FIG. **5** and FIG. **7**, each of the receiving portions **156** has a flat surface formed at a bottom surface of the receiving portion **156**. In other words, the flat surface of the embodiment is an upper surface of the above-projection portion of the partition wall **152**. The flat surface of the receiving portions **156** is perpendicular to the up-down direction, i.e. in parallel with a horizontal surface (an XY surface). The flat surface serves as a first support portion **158**. The first support portion **158** is positioned backward and downward of the upper contact portions **112**. In other words, the upper contact portion **112** is positioned forward and upward of the first support portion **158**. In this embodiment, a guide portion **160** is formed between the contacted portion **154** and the first support portion **158** in the front-back direction. The guide portion **160** has a smooth surface. The guide portion **160** may have a curved surface when seen along the pitch direction. The guide portion **160** may have an oblique surface oblique to the front-back direction and the up-down direction.

As shown in FIG. **6** and FIG. **7**, a plurality of second accommodation portions **170** is formed at a front and lower part of the holding member **140**. The second accommodation portion **170** communicates with the insertion opening **142** and opens forward of the holding member **140**. As shown in FIG. **7**, a plurality of ribs **172** is formed at a front and lower

part of the holding member **140**. The rib **172** is positioned between the neighboring second accommodation portions **170** in the pitch direction.

As shown in FIG. **5** to FIG. **7**, each of the ribs **172** has an upper surface and an oblique surface **176**. The upper surface is in parallel with the horizontal surface. The oblique surface **176** is sloped down backward from the upper surface. The upper surface of the rib **172** serves as a second support portion **174**. The second support portion **174** is positioned forward and downward of the upper contact portion **112**. As understood from FIG. **5** and FIG. **6**, the first support portion **158** and the second support portion **174** are positioned on a same horizontal surface. In other words, positions of the first support portion **158** and the second support portion **174** in the up-down direction are equal with each other. The oblique surfaces **176** constitute a part of the insertion opening **142**. As shown in FIG. **6**, when seen along the pitch direction, the oblique surface **176** and the contacted portion **154** cross each other. In other words, the first support portion **158** is positioned apart from the second support portion **174** in the pitch direction. The first support portion **158** and the second support portion **174** are not positioned on the same XZ surface.

With reference to FIG. **6**, the lower contact **120** is inserted into the second accommodation portion **170**. The lower held portion **126** is press-fitted into the holding member **140** so that the lower contact **120** is held by the holding member **140**. As shown in FIG. **1** to FIG. **3**, the holding member **140** holds the lower contacts **120** so that the lower contacts **120** are arranged in a line in the pitch direction. When the lower contact **120** is attached to the holding member **140**, the lower contact portion **122** is projected upward from the upper surface (i.e. the second support portion **174**) of the rib **172**. The lower contact portion **122** is positioned in the insertion opening **142** when seen along the front-back direction. The lower contact portion **122** is elastically supported by the lower spring portion **124** so as to be displaceable in the up-down direction.

As shown in FIG. **1** to FIG. **3**, the upper contacts **110** and the lower contacts **120** are grouped into two groups (a right group R and a left group L). In other words, the first accommodation portions **150** and the second accommodation portions **170** are also grouped into the right group R and the left group L. The holding member **140** has a key **180** formed between the right group R and the left group L in pitch direction. As is clear from FIG. **2** and FIG. **3**, the key **180** is not positioned at the center of the holding portion **140** in the pitch direction. In other words, the right group R and the left group L are not symmetric about the center of the hold member **140** in the pitch direction. The mating portion **210** of the connection object **200** has a key (a notch: not shown) which corresponds to the key **180**. By adjusting the key of the mating portion **210** with the key **180** of the mating portion **210**, the mating portion **210** can be inserted into the insertion opening **142** properly.

As shown in FIG. **4** to FIG. **6**, the holding member **140** has two locating bosses **184**. The locating bosses **184** are positioned near both ends of the holding member **140** in the pitch direction and project downward. The substrate (not shown) has two holes which correspond to the locating bosses **184**. The electrical connector **100** is suitably located on the substrate by inserting the locating bosses **184** into the holes of the substrate. The upper fixed portions **118** of the upper contacts **110**, the lower fixed portions **128** of the lower contacts **120** and the hold downs **130** are fixed to the substrate and connected with a conductive pattern or a soldering portion.

In this embodiment, the connection object **200** is connected with the electrical connector **100** as follows. As shown in FIG. **8** and FIG. **9**, the mating portion **210** of the connection object **200** is inserted into the insertion opening **142** along the oblique direction. The mating portion **210** is brought into contact with the contacted portion **154** (FIG. **9**: a first position). As understood from a movement of the mating portion **210** shown in FIG. **8** and FIG. **9**, when the mating portion **210** is inserted into the electrical connector **100** through the insertion opening **142**, the mating portion **210** does not push the upper contact portion **112** nor the lower contact portion **122**, in other words, the mating portion **210** does not receive restoring force of the upper contact **110** nor the lower contact **120**. Thus, the mating portion **210** can be inserted into the insertion opening **142** with low insertion force.

As shown in FIG. **9** and FIG. **10**, the mating portion **210** is brought down until the mating portion **210** is in parallel with the horizontal direction (FIG. **10**: a second position). In the state shown in FIG. **10**, the mating portion **210** pushes the upper contact portion **112** upward and the lower contact portion **122** downward. The mating portion **210** received the restoring forces from the upper contact **110** and the lower contact **120**.

As shown in FIG. **10** and FIG. **11**, the mating portion **210** is moved backward so that the receiving portion **156** receives the mating portion **210** (FIG. **11**: a third position). The guide portion **160** guides the mating portion **210** to smoothly move from the second position to the third position. Because of the guide portion **160**, the mating portion **210** is not obstructed by an upper end part of the contacted portion **154**. As a variation example of the guide portion **160**, the mating portion **210** may have a curved surface formed at the front end portion **212** (FIG. **8**), thus the guide portion **160** of the holding member **140** may be omitted. With this structure, the curved surface of the mating portion **210** guides the mating portion **210** to smoothly move from the second position to the third position.

As shown in FIG. **11**, when the mating portion **210** is positioned at the third position, the first support portion **158**, the second support portion **174** and the upper contact portion **112** support the mating portion **210**. The upper contact portion **112** is electrically connected with the upper contact (not shown) of the mating portion **210**. The lower contact portion **122** is electrically connected with the lower contact (not shown) of the mating portion **210**.

As shown in FIG. **11**, the electrical connector **100** is supported by three points (the first support portion **158**, the second support portion **174** and the upper contact portion **112**) seen along the pitch direction. In detail, the upper contact portion **112** pushes the upper surface **202** of the mating portion **210** while the first support portion **158** and the second support portion **174** support the lower surface **204** of the mating portion **210**. The upper contact portion **112** is positioned between the first support portion **158** and the second support portion **174** in the front-back direction. In other words, for the mating portion **210**, a pushed area pushed by the upper contact portion **112** is positioned between a supported area supported by the first support portion **158** and a supported area supported by the second support portion **174** in the front-back direction. Therefore, the mating portion **210** does not receive undesired force which may bend and deform the mating portion **210**. Even if the mating portion **210** has a thin shape, the mating portion **210** can be inserted smoothly, and the electrical connector **100** can maintain a connection with the connection object **200**.

In the above embodiment, the contacted portion **154** and the receiving portion **156** are integrally formed with the partition wall **152** (see FIG. **7**). However, the contacted portion **154** and the receiving portion **156** may be formed apart from the partition wall **152** in the pitch direction. FIG. **12** shows a first variation example. As understood from FIG. **12**, the

electrical connector **100** has two contacted portions **154** and two receiving portions **156**. The contacted portions **154** and the receiving portions **156** are formed near both ends of the insertion opening **142** in the pitch direction.

The upper surface of the rib **172** serves as the second support portion **174**. However, for example, the lower contact portion **122** may serve as the second support portion. In this case, the lower spring portions **124** of the lower contacts **120** may be strengthened so as to support the mating portion **210**. In another example, the upper surface of the rib **172** and the lower contact portion **122** may serve as the second support portion.

FIG. **13** and FIG. **14** show a second variation example. An electrical connector **100***a* does not have the lower contact portion **120** (FIG. **6**). The connector **100***a* is connected with a mating portion **210** which has no contacts at the lower surface **204**. As shown in FIG. **13**, a holding member **140***a* of the electrical connector **100***a* does not have the second accommodation portions **170** nor the ribs **172** (FIG. **12**) but has a first accommodation portions **150***a* a lower support portions **172***a*.

A shape of the lower support portion **172***a* is similar to the rib **172** (FIG. **12**) in cross-section seen along the pitch direction. The lower support portion **172***a* has an upper surface and a slope **176***a*. The upper surface is perpendicular to the up-down direction and serves as a second support portion **174***a*.

As shown in FIG. **13**, the holding member **140***a* has contacted portion **154***a* and receiving portion **156***a*. The receiving portion **156***a* is positioned backward and upward of the contacted portion **154***a*. The receiving portion **156***a* has a bottom surface which serves as a first support portion **158***a*. A guide portion **160***a* is formed between the contacted portion **154***a* and the first support portion **158***a* in the front-back direction. The first support portion **158***a* and the second support portion **174***a* are positioned on a same horizontal surface.

As shown in FIG. **14**, the electrical connector **100***a* supports the mating portion **210** at three points (the first support portion **158***a*, the second support portion **174***a* and the upper contact portion **112**). In other words, for the mating portion **210***a*, a pushed area pushed by the upper contact portion **112** is positioned between a supported area supported by the first support portion **158***a* and a supported area supported by the second support portion **174***a* in the front-back direction. Therefore, the mating portion **210** does not receive undesired force which may bend or deform the mating portion **210**.

FIG. **15** to FIG. **17** show a third variation example. The electrical connector **100***b* does not have the lower contact **120** (FIG. **11**) but has a lower support portion **172***b* which has a projection **173**. The holding member **140***b* of the electrical connector **100***b* has first accommodation portions **150***b* and an insertion opening **142***b*. The lower support portion **172***b* is positioned forward and downward of the insertion opening **142***b*.

As shown in FIG. **15**, an upper surface of the projection **173** serves as the second support portion **174***b*. As shown in FIG. **16**, the upper surface of the projection **173** has a front edge **173***f* and a rear edge **173***r*. The rear edge **173***r* makes the lower limit of the insertion opening **142***b*. The lower surface **204** of the mating portion **210** slides on the rear edge **173***r* when the mating portion **210** is inserted into the insertion opening **142***b*.

The holding member **140***b* has contacted portion **154***b* and receiving portion **156***b*. The receiving portion **156***b* is positioned backward and upward of the contacted portion **154***b*. The receiving portion **156***b* has a bottom surface which serves as a first support portion **158***b*. A guide portion **160***b* is formed between the contacted portion **154***b* and the first support portion **158***b* in the pitch direction. The first support portion **158***b* and the second support portion **174***b* are positioned on a same horizontal surface. As shown in FIG. **15**, the guide portion **160***b* of the embodiment has a curved surface.

As shown in FIG. **15** to FIG. **17**, the mating portion **210** is connected with the electrical connector **100***b* as follows. The mating portion **210** is inserted into the insertion opening **142***b* in the oblique direction. The lower surface **204** of the mating portion **210** slides on the rear edge **173***r* of the second support portion **174***b* and moves till the mating portion **210** is brought into contact with the contacted portion **154***b* (FIG. **16**: a first position). The mating portion **210** is brought down till the mating portion **210** is in parallel with horizontal direction (a second position). The mating portion **210** is moved backward and is received by the receiving portion **156***b* (FIG. **17**: a third position). In this embodiment the guide portion **160***b* has the curved surface. As understood from FIG. **16** and FIG. **17**, when the mating portion **210** is brought down, the front end portion **212** of the mating portion **210** slides on the curved portion of the guide portion **160***b* and is guided to the receiving portion **156***b*. In this embodiment, the mating portion **210** is immediately moved from the second position to the third position. The electrical connector **100***b* supports the mating portion **210** at three points (the first support portion **158***b*, the second support portion **174***b* and the upper contact portion **112**). Therefore, the mating portion **210** does not receive undesired force which may bend or deform the mating portion **210**.

Each of the first support portions **158**, **158***a*, **158***b* and the second support portions **174**, **174***a*, **174***b* has the upper surface in parallel with the horizontal surface. However, at least one of the first support portion **158**, **158***a*, **158***b* or the second support portion **174**, **174***a*, **174***b* may have a projection shape. Even in this case, it is preferred that the first support portion and the second support portion are positioned at the same horizontal surface.

In above-described embodiment, each of the second support portions **174**, **174***a*, **174***b* is a part of the holding member **140**, **140***a*, **140***b*. However, the lower contact portion **122** may serve as the second support portion. In other words, the only lower contact portion **122** of the lower contact **120** may support the mating portion **210**, and the upper surface of the rib **172** (FIG. **7**) and the lower support portion **172***a*, **172***b* (FIG. **13** and FIG. **15**) does not support the mating portion **210**. In this case, it is preferred that the lower contact portion (the second support portion) **122** and the first support portion **158**, **158***a* or **158***b* is positioned on the same horizontal surface.

The electrical connectors **100**, **100***a*, **100***b* of the embodiments can be connected with the connection **200** object without the engage portion (the latch portion) of the JP-A H9-139261. However, the electrical connector of the present invention may use a latch means accessorily.

The present application is based on a Japanese patent application of JP 2011-142287 filed before the Japan Patent Office on Jun. 27, 2011, the contents of which are incorporated herein by reference.

While there has been described what is believed to be the preferred embodiment of the invention, those skilled in the art will recognize that other and further alternative embodiments may be made thereto without departing from the spirit of the invention, and it is intended to claim all such embodiments that fall within the true scope of the invention.

What is claimed is:

1. An electrical connector configured to be connected with a connection object which has a mating portion having a plate shape, wherein the electrical connector comprises:

an insertion opening into which the connection object is inserted in an oblique direction;

a contacted portion with which the mating portion inserted through the insertion opening is brought into contact;

a receiving portion receiving the mating portion and having a first support portion, the receiving portion being positioned at a back of the contacted portion;

a contact portion positioned forward and upward of the first support portion and being displaceable in an up-down direction; and

a second support portion positioned forward and downward of the contact portion,

the mating portion being inserted through the insertion opening so as to be positioned at a first position where the mating portion is in contact with the contacted portion, the mating portion being brought down so as to be positioned at a second position where the mating portion is in parallel with a front-back direction perpendicular to the up-down direction, the mating portion being moved backward so as to be positioned at a third position where the mating portion is received by the receiving portion and supported by the first support portion, the second support portion, and the contact portion.

2. The electrical connector according to claim **1**, wherein a mating contact is formed on the mating portion, the mating contact being connected with the contact portion when the mating portion is positioned at the third position.

3. The electrical connector according to claim **1**, wherein the electrical connector further comprises plurality of upper contacts and a holding member which holds the upper contacts in a pitch direction perpendicular to the front-back direction and the up-down direction, each of the upper contacts having an upper contact portion and a spring portion, the upper contact portion serving as the contact portion, the spring portion elastically supporting the upper contact portion, the contacted portion and the receiving portion being formed as a part of the holding member.

4. The electrical connector according to claim **3**, wherein the receiving portion has a flat surface formed at a bottom of the receiving portion, the flat surface being perpendicular to the up-down direction and serving as the first support portion.

5. The electrical connector according to claim **4**, wherein a guide portion is formed between the contacted portion and the first support portion, the guide portion connecting the contacted portion and the first support portion smoothly.

6. The electrical connector according to claim **3**, wherein the second support portion is formed as a part of the holding member.

7. The electrical connector according to claim **3**, wherein the electrical connector further comprises a plurality of lower contacts, the holding member holding the lower contacts in the pitch direction, each of the lower contacts having a lower contact portion serving as the second support portion.

8. The electrical connector according to claim **6**, wherein an upper end of the first support portion and an upper end of the second support portion are positioned on a same horizontal surface.

9. The electrical connector according to claim **3**, wherein the holding member has a plurality of accommodation portions and a plurality of partition walls, each of the accommodation portions being positioned between the neighboring ones of the partition walls, the contacted portion and the receiving portion being formed at the partition wall.

10. The electrical connector according to claim **3**, wherein the holding member has a plurality of accommodation portions and a plurality of partition walls, each of the accommodation portions being positioned between the neighboring ones of the partition walls, the contacted portion and the receiving portion being formed so as to be positioned apart from the partition wall in the pitch direction.

11. The electrical connector according to claim **1**, wherein the connection object is a module having a circuit board, the electrical connector being a card-edge connector connected with the module.

12. The electrical connector according to claim **7**, wherein an upper end of the first support portion and an upper end of the second support portion are positioned on a same horizontal surface.

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